

Key Messages

- A few point exceedences of Navajo Nation screening levels were observed between 8/10 and 8/16 – particularly total lead and total & dissolved aluminum. Currently well below NNSLs, excepting Mexican Hat on 8/17. All metals below on 8/18.
- San Juan River water is at safe levels for livestock watering and cropland application.
- Elevated results were associated with the plume passing but have trended downward.
- Many elevated results appear to be consistent with events that happened in the background monitoring period.
- Heavy metal levels in sediments don't appear to be elevated – all below action levels; however, monitoring should continue.
- Yellow Iron Hydroxide precipitates and complexes with metals are generally not toxic; however, some metal-hydroxide interactions vary and are pH and oxidation dependent.
- Monitoring should continue

Background

On August 5, 2015, EPA was conducting an investigation of the Gold King Mine near Silverton, Colorado, to: assess the on-going water releases from the mine, treat mine water, and assess the feasibility of further mine remediation. While excavating above the old adit, pressurized water began leaking above the mine tunnel, spilling about three million gallons of water stored behind the collapsed material into Cement Creek, a tributary of the Animas River.

EPA is working closely with first responders and local, state and tribal officials to ensure the safety of citizens affected by the Gold King Mine release. The Agency has activated its Emergency Operations Center in Washington D.C., to ensure coordination among its regions, laboratories and national program offices. EPA is closely coordinating with the officials in Colorado, New Mexico, Utah, Southern Ute tribe and Navajo Nation. EPA Region 8 is working to contain the leak and flow from the mine is now controlled. EPA has also deployed federal On-Scene Coordinators and other technicians in Colorado, New Mexico and Navajo Nation to assist with preparations and first response activities in these jurisdictions. EPA is sharing information as quickly as possible with the community, as experts work to analyze any effects the spill may have on drinking water, public health and agriculture.

Concentrations of metals in the water or sediments from the Gold King mine were released in highly acidic solution/suspension as a result of pyrite oxidation inside the mine. Based on sampling results EPA anticipates somewhat elevated levels of aluminum, arsenic, iron and manganese, and perhaps cadmium, zinc and copper in surface waters. These constituents should be expected in the discharge but concentrations are not expected to increase in San Juan River sediments as a result of the release.

The purpose of this paper is to:

- Present the risk message for agricultural stakeholders
- Provide general comparisons of measured contaminants of concern in surface water and sediment to risk screening levels and pre-event conditions
- Address concerns about sediment contamination and ferric hydroxide complexes

Data Summary

Variability of our surface water data from the San Juan River is consistent with the pre event/historical variability in results from the San Juan watershed. Results indicate that the plume from the Gold King Mine release may have reached the Four Corners sampling station on August 11th, as results seem to peak at the Four Corners station at that time. Similarly, results indicate a peak at the Hogback station, also on August 11th, trailing off and stabilizing at very low concentrations for metals of interest.

Variability of data throughout the river system, compounded with events and inputs downstream, seem to mask the Gold King Mine release event concentrations beyond the Four Corners sampling station. As examples, EPA believes that storms on August 8th and August 12th and likely contaminant input locations such as McElmo Creek, potentially the Chinle Wash and other significant non-point sources, create variability such that we cannot conclude that later results are related solely to the Gold King Mine release.

Impacts to Agriculture and Wildlife

From the point of view of agricultural use, EPA is concerned with suspended and dissolved metals in the water used for livestock watering and agricultural supply. As the acid mine drainage from the Gold King Mine release mixed with the neutral or alkaline water, for example in the Animas River, pH rose and heavy metals precipitated or “dropped out.” However, fine particles might remain suspended (observed by total concentrations) for some distance (Rufus Chaney, Pers. Comm.).

While EPA has not observed fish kills or other evidence of actual impact to wildlife or domestic animals in the San Juan River, we believe it is prudent to perform predictive risk assessment to gauge impacts of the spill on future outcomes for livestock and crop safety. Throughout the sampling period, across EPA and NNEPA's joint surface water sampling stations, most metals results fell below Navajo Nation screening levels with some scattered peaks exceeding levels in point-to-point comparisons. Results have also trended downward, on August 16th & 17th exceeding Navajo Nation agricultural screening levels in one location for one metal (dissolved Aluminum) and clearly below NNSLs on 8/18. The elevated station on the 17th, Mexican Hat, has historically high metal concentrations and this result is not expected to be related to the Gold King mine release. All metal concentrations in sediments throughout the sampling period were below Recreation Screening Levels (RSLs) representing pre and post release conditions.

Using water quality data collected from the San Juan River, the Utah Department of Agriculture and Food (UDAF) lifted all advisories against using San Juan River water for crop irrigation and livestock watering on August 14, 2015. Based on the latest UT Department of Environmental Quality evaluation of the San Juan River water sample data, Utah State University's veterinary toxicologist reports that the river's highest levels of contamination posed no adverse effects on plants, soils and animals, only short-term and minimal exposure risks. The UDAF advises farmers and ranchers to remain cautious and report any changes in the health of their crops and livestock.

An option for consideration might be to allow water to flow into settling ponds to remove the fine suspended solids before irrigation use. This is consistent with actions taken on irrigation ditches by Navajo agricultural officials and EPA will provide ongoing support with agricultural ditch surveillance and monitoring (Dr. Rufus Chaney, USDA, Pers. Comm.).

Navajo Nation Screening Levels for Livestock and Agricultural Supply Water

EPA compared all surface water data to Navajo Nation screening levels for livestock and agricultural supply water, to better inform the risk communication regarding public uses of the San Juan River during and after the Gold King Mine release. According to Navajo Nation Surface Water Quality Standards (2007), standards for livestock watering are meant to be protective for water consumed by livestock (an “ingestion” pathway estimation). Standards for agricultural supply water use of the water used for crops that could be used for human consumption.

The 2007 Standards do not provide duration or frequency; however, point exceedances that have been observed to date do not represent an estimate of the true average concentration of the water, such that ingestion would have undesirable outcomes in food sources (contaminant accumulation). Because that contact duration may be unrealistic and single points are not estimates of average concentrations, these comparisons are more conservative than typical risk assessment screening. EPA’s point comparisons do not represent risk estimates but are useful risk communication benchmarks.

Al and Fe are also found in percent concentrations in soils naturally. Although dissolved aluminum exceeded NNSLs on some days, its toxicity and potential for uptake is not well established. Also, Al toxicity is dependent on water and soil pH. If water or crop land soil is neutral or calcareous (alkaline), uptake will be less than anticipated by the NNSLs (Dr. Rufus Chaney, USDA, Pers. Comm.).

How do concentrations compare to background conditions?

EPA continues to analyze surface water and sediment samples and has begun monitoring the San Juan River to draw comparisons to baseline conditions. We will continue to research information on a pre-event river conditions for evaluation and transmission to Navajo Nation authorities. Sources of information include STORET data, Animas and San Juan Watersheds Historical Water Quality Data Summary, United States Geological Survey reports and Navajo surface water quality assessment reports. In particular EPA used a background data set from the San Juan River collected by NNEPA between September 2011 and September 2013.

Results of surface water samples were compared to past events and compared to estimated background concentrations, based on a data set provided by the NNEPA for the San Juan River. Results (September 2011 to September 2013). In this data set total lead data ranged from ND – 330 ug/l (NN Ag Screening Level: 100 ug/l), total aluminum ranged from 14 – 150,000 ug/l and dissolved aluminum ranged from ND – 4,300 ug/l (NN Ag Screening level: 5,000 ug/l).

Sediments:

Results collected up to August 18th showed that all sediments sampled throughout the San Juan River were below 64-day risk-based Recreational Screening Levels for all metals. Also, results for all metals in sediments were significantly lower than the highest upstream concentrations (in the upper reaches of the Animas River).

Any sediments which were deposited from the Gold King release anywhere along the flow path may be resuspended; however, it is important to note that each resuspension event will have lower metals concentrations than the original or the previous event. Since sediment concentrations in the San Juan are so low to begin with, short-term resuspension events are not expected to contaminate downstream sediments (Dr. Ned Black, Pers. Comm.).

Hydroxide Comments:

The yellow color of the spill was from newly precipitated iron oxides. It is important to note that iron is a component of every soil and is a necessary human and plant nutrient, so that color alone - while disturbing - does not indicate toxicity. Yellow or orange sediments are a mixture of iron oxides and hydroxides in various formulations.

Iron oxides and hydroxides are not toxic by themselves except they can smother benthic invertebrates on the stream/river bottom. Historic data from benthic macroinvertebrate bioassessment along the San Juan, could be used for comparison with new bioassessments in order to determine if there is any evidence of actual ecological impacts. Since the river experiences very high sediment pulses on a regular basis, it is likely the fish and other members of the biological community are well-adapted to high turbidity/high suspended sediment events. It is possible that iron hydroxides further upstream may have contaminants sorbed to them. These could be remobilized. In neutral and alkaline conditions, the hydroxides make the metals less toxic although these can be liberated under acidic conditions (Dr. Ned Black, Pers. Comm.).

Conclusions

Levels of metals in surface water and sediment have returned to pre-release conditions. EPA agrees with Colorado, New Mexico and Utah public health authorities, that the San Juan River is safe for recreational and agricultural purposes. A broader monitoring regime in the San Juan River watershed should be implemented to inform questions about long term impacts from the Gold King Mine Release.

ATTACHMENT 1

Daily Summary of Exceedences of Agricultural Screening Levels

Sediment 8/10-16

Reported concentrations of metals in sediment were compared to 64-day recreational screening level (RSL) developed by R8 for this incident. *All metals in sediment concentrations were below (well below in most cases) the sediment RSLs.*

Surface Water 8/10-18

8/17-18 Summary

1. Dissolved aluminum at station SJMH (Mexican Hat - 17,000 ppb) exceeded the Navajo Nation (NN) agricultural screening level of 5,000 ppb (8/17 only).

8/16 Summary

1. Dissolved aluminum at station SJPF (Piute Farms - 7,800 ppb) exceeded the Navajo Nation (NN) agricultural screening level of 5,000 ppb.

8/14-15 Summary

1. Aluminum (dissolved) at DS, McElmo Creek, Montezuma Creek, Bluff/Butler and Mexican Hat (range 5,400 – 13,000 ppb) exceeded the NN agricultural screening level (5,000 ppb, dissolved) on 8/14.
2. Lead at Bluff/Butler on 8/14 (120 ppb) and at Mexican Hat on 8/14 & 8/15 (110-120 ppb) exceeded the NN livestock screening level (100 ppb).

8/13 Summary

1. Dissolved aluminum concentrations at 3 stations (DS, ME & MH; 5,500-95,000 ppb) exceed the NN agricultural screening level (5,000 ppb dissolved).
2. Lead (total) at station DS (110 ppb) marginally exceeded the NN livestock screening level (100 ppb total) but not the NN agriculture screening level (10,000 ppb total).
3. Dissolved vanadium concentrations at 2 stations (DS & MH; 110 ppb) marginally exceeded the NN agricultural and livestock screening levels (100 ppb dissolved for both). Dissolved vanadium concentrations at 2 stations (DS & MH; 110 ppb) marginally exceeded the NN agricultural and livestock screening levels (100 ppb dissolved for both).

8/12 Summary

No exceedences of NN screening levels were observed on this date.

8/10-11 Summary

No exceedences of NN screening levels were observed on this date.

ATTACHMENT 2 - INTERNAL

Mass Balance from the Spill

Based on data from the spill site, the following are estimates of expected contaminant mass on 10 hectares (ha) of soil relative to river and sediment concentrations (assumes all of the sediment from the plume stayed on 10 has):

- There were 14.25 tons of Fe in the spill- that is in comparison to the US soil median concentration of 3.9 tons per 10 ha
- There were 1.44 tons of Al in the spill- that is in comparison to the US soil median concentration of 9.34 tons per 10 ha
- There was a total of about 12 kg As in the spill- enough to raise the soil concentration of 10 ha by 0.6 ppm. Median concentrations in US soil is 5.2 ppm
- There was a total of about 292 kg Pb in the spill- enough to raise the soil ppm in 10 ha by 14.6 ppm.